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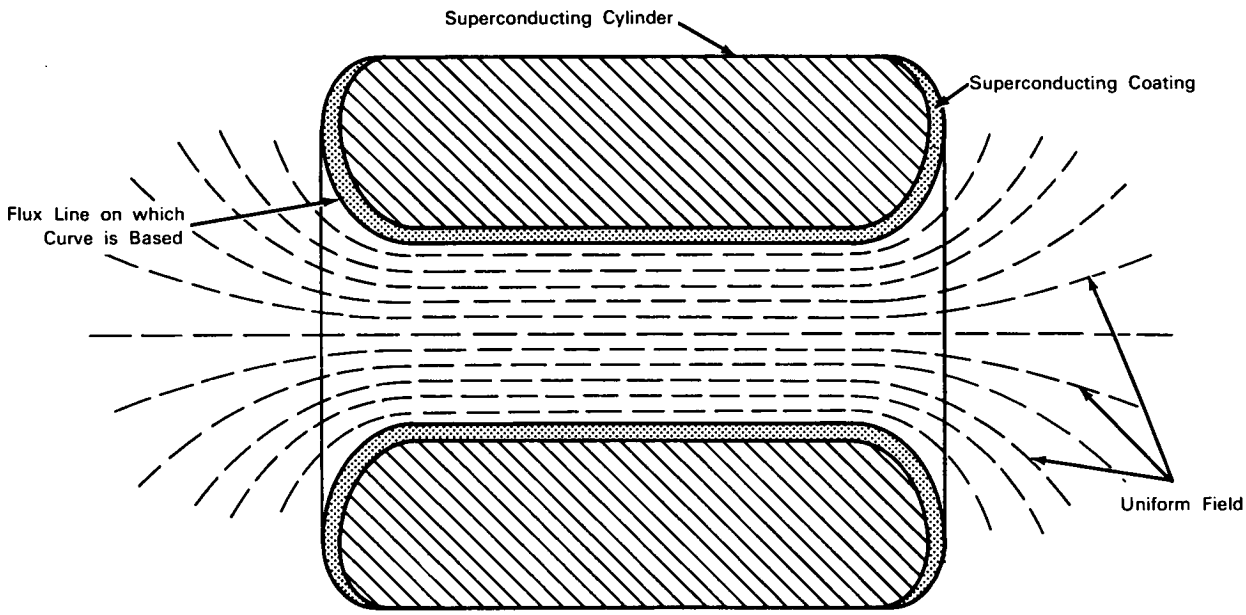
NASA TECH BRIEF

Shaped Superconductor Cylinder Retains Intense Magnetic Field



The problem: Containing a large uniform magnetic field in a superconducting cylinder when the field is intense enough to cause the ends of the cylinder to become nonsuperconducting. When a superconducting cylinder is filled with an axial magnetic field, a very intense field occurs near the ends of the cylinder. This magnetic field may be more intense than the critical field of the superconductor and results in the cylinder ends becoming nonsuperconducting. If the cylinder is constructed with thin walls, the entire cylinder may become nonsuperconducting, allowing only a small field to be trapped by the cylinder.

The solution: Shaping a superconductor cylinder so that the curve of the inner walls reduces maximum flux densities and thus permits a stronger and more uniform magnetic field.

How it's done: The inner walls of the cylinder are flared near the top and bottom to join smoothly with the end surfaces, and are coated with a thin superconducting material. The curve of the inner surface is developed from a plot of the flux lines of the field that must be contained in the working volume. The flux line chosen as a guide for the curve is a compromise between maximum field strength of working volume and length of the cylinder. A large uniform magnetic field having a predictable configuration can be contained in a superconducting cylinder of this design.

The curve selected for the cylinder in the illustration approximately follows the outer flux line that was considered to be the best compromise among the criteria used in the selection process.

(continued overleaf)

Notes:

1. This innovation will be useful in the production of larger, more homogeneous magnetic fields in superconducting cylinders and should prove to be of value in experimentation or for further analysis.
2. It will increase the capacity of superconducting cylinders to store magnetic fields of uniform cross-section and would be useful in equipment requiring magnetic instrumentation.
3. For further information about this innovation inquiries may be directed to:

   Technology Utilization Officer
   Jet Propulsion Laboratory
   4800 Oak Grove Drive
   Pasadena, California, 91103
   Reference: B63-10238

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated.

Source: A. F. Hildebrandt and Hugo Wahlquist (JPL-381)